FLX 5510

USER MANUAL

601-337A

TESEQ

Advanced Test Solutions for EMC

FLX 5510

USER MANUAL

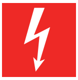
CONTENTS

1 SAFETY INSTRUCTIONS

1.1 Classification of dangers

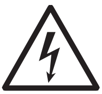
!	**CAUTION! It is imperative that you read the following safety instructions and all safety instructions in the manuals of connected peripheral systems before installing and starting the tester for the first time.** **The electrical and mechanical safety equipment must not be removed, put out of operation or bypassed. Handle all safety equipment with care. If a safety device should be broken or is not working, the system must be put out of operation until the safety equipment is repaired or exchanged and fully in working order again.**

The safety instructions in this manual are classified in different levels. The table below shows a survey over the relation of symbols (ideograms) and keywords to the specific risk and the (possible) consequences.

Warning symbol	Signal word	Definition
	**DANGER!**	Possibly dangerous situation, that may cause damage to persons or heavy damage to the tester and/or the equipment.
	**CAUTION!**	Situation, that may cause damage to the tester and/or the equipment.
	**NOTE!**	User tips and other important or useful information and comments.

1.2 Warning symbols on the test system

Different warning symbols are placed on the test system. The table below shows a survey over the relation of symbols (ideograms) and keywords to the specific risk and the (possible) consequences.

Pictogramm	Definition
	Possibly dangerous situation that can result in injuries and serious damage to the equipment.
	Situation that can result in damage to the equipment.

1.3 Excess voltage category

The test equipment as described in this manual, is related to the excess voltage category II according IEC 60664.

1.4 Range of validity

These instructions are valid for the complete installation. Further safety regulations for components installed in this test equipment or additional installed devices are not suspended by these instructions.

1.5 Safety of operation

Reliable function and safe operation of the test equipment are ensured only if the relevant general precautions as well as all safety instructions given in this manual are observed.

In particular, observe the following:

- Connect the device only to line voltage that confirms to the power specification given on the type label (on the back of the test equipment).
- Do not touch any conductive parts at the output connectors, the fixture and the test object during a test run.
- Disconnect the device from the mains before opening the casing for main tenance or repair.
- During the operation of the test equipment always observe the relevant rules of ESD (Electro Static Discharge) protection.
- To guarantee the EMC features of the device, the control computer must meet the requirements of the EN 50082, 55011, 61000 standard.
- Make sure the environmental conditions described in chapter 7.1 Environmental conditions exist.

1.6 Personnel

The equipment may be operated by qualified personnel only. It may be opened for adjustment, maintenance or repair by authorized staff only. Teseq or its representative may not be held responsible for service not performed by Teseq personnel.

1.7 Responsibility for safety precaution

The owner, operation supervisor and/or operator of the equipment are responsible for safety. The owner, operation supervisor and/or operator are in charge of any safety measures that do not directly concern the test equipment itself. For details, see the relevant accident prevention regulations. See also the safety instructions in the manufacturer's manual included with any additional instrument or device you intend to use with your Teseq test equipment.

1.8 Reduction in operational safety

If you have any reasons to suppose that the test equipment is not completely safe, you must shut it down and put it out of operation. Moreover, you must mark or label the equipment appropriately so it will not inadvertently be put into operation again. You should then call authorized service personnel for assistance.

1.9 As agreed use

The test equipment must exclusively be used for testing electrical devices and components indicated in the technical specifications.

!

WARNING! This guide does not supersede the NSG 5500 User manual. The guide is meant to be used only in conjunction with the NSG 5500 User manual. Be sure to read, understand and observe all relevant instructions in the NSG 5500 User manual.

2 INTRODUCTION

2.1 Introduction

The FLX 5510 is a module for the NSG 5500 where you, as the user, are also the designer. You can create your own pulse with the pulse shape, energy, and behavior under load is defined by you, and your own requirements.

Essentially, you define the R/C network and leave the rest up to us. Your own selection of components is charged using the high voltage power supply (HVPSU) from the NSG 5500 and can be either coupled using our built-in the high-quality, 100 A coupling/decoupling network (CDN) or taken, alternatively, from the BNC output for capacitive, or other application-specific coupling methods.

Of course the NSG 5500 and its available modules meet almost every type of automotive transient immunity simulation. This module is for users who need something beyond the basics:

- Users who have a specific problem in the electrical environment who want to simulate a real-world pulse that was detected.
- Users who want to explore the limits of the DUT (device under test)
- Users who are working in cutting edge, new environments where the pulses have not yet been defined: hybrid-electric vehicles, aerospace etc.

Typical causes of these types of pulses are defined in ISO 7637-2 as:

- Transients due to supply disconnection from inductive loads; it applies to a DUT if, as used in the vehicle, it remains connected directly in parallel with an inductive load
- Transients due to sudden interruption of currents in a device connected in parallel with the DUT due to the inductance of the wiring harness

2.2 Features

The FLX 5510 is shipped with two DIY 5510 submodules, one populated with an example 3ms circuit, and one unpopulated, ready to accept your own project. Of course you can use modify or reuse the example DIY 5510 for additional projects, or keep it as the example. Additional DIY 5510 submodules are available separately.

The FLX 5510 can be fitted into an available slot in the NSG 5510, but we recommend temorarily replacing the MT 5510 or using the NSG 5500-2 which contains space for additional modules.

The FLX 5510 module can generate pulses up to 30 ms pulse width (td) which is exactly where the very flexible load dump generator LD 5550 starts. The FLX 5510 and each DIY 5510 submodule can generate pulses over 600 V. The DIY 5510 features parallel discharge resistors to the storage capacitors to make sure that the modules return to a safe, discharged state very quickly after a DIY 5510 is removed.

The DIY 5510 also contains a BNC output for use with other external couplers such as a CDN 500, capacitive coupling, for use with a LISN etc.

The DIY 5510 features a special rugged coating that is writeable. The surface is also reusable because it is both writeable and erasable if a pencil is used.

Only one pulse (and its corresponding characteristics) can be programmed per DIY 5510 sub-module, but the voltage, coupling modes, polarity and both pulse repetition (T1) and battery off time (T2) are programmable.

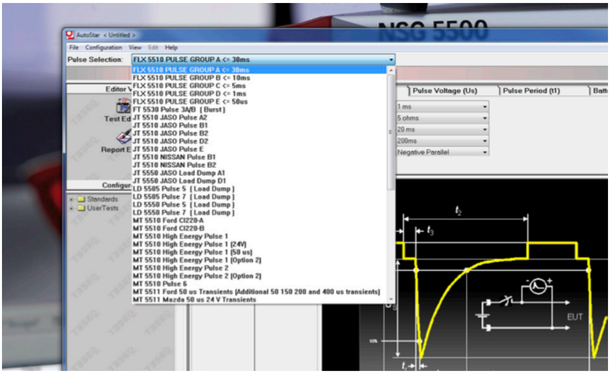
The FLX 5510 is compatible with any number of DIY 5510 submodules.

3 INSTALLATION/SETUP

The FLX 5510 is delivered with two DIY 5510 modules, one populated with an example circuit, and one empty module ready to accept your project.

The FLX 5510 solutions dev. kit

You will, however, need to install a patch that includes the data files and configuration files for the DIY 5510.

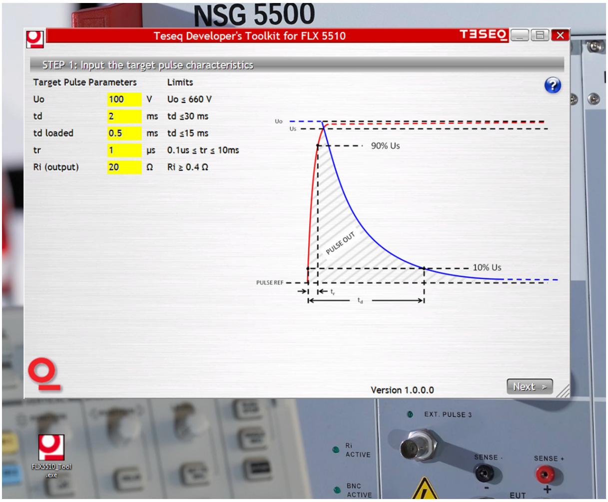


The FLX 5510 software patch

You will also receive two tools to help you design the circuit with the pulse characteristics of your pulse:

- An Excel Sheet “Mod Sheet Pulse Network Components”
- A Windows Application “FLX5510_Tool.exe” wizard

These two tools have the same features, but the wizard is more user friendly, and the excel sheet is for those engineers who are curious about the formulas that are used. Of course, you can modify and save the Excel table, whereas you can’t save the settings or values of the wizard.



The supplied FLX 5510 wizard

4 CALCULATING THE PULSE

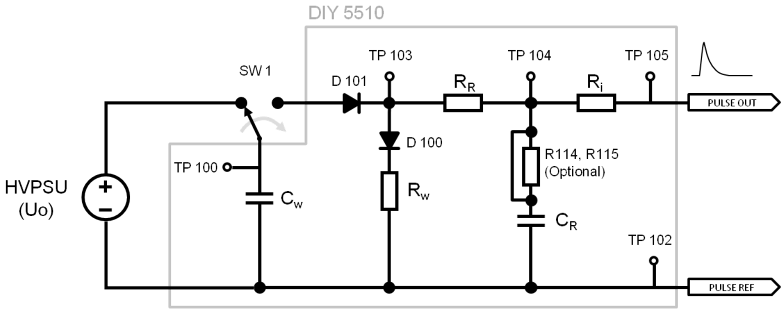
The pulse that will be populated in the DIY 5510 is first calculated using the provided excel sheet or the the FLX 5510 wizard. Of course, the goal is to know what components to use, but the starting point is the pulse parameters.

To start, you will need to know:

- To what value you will want to charge the storage/buffer capacitor. This can be related to the ultimate peak voltage output seen at the DUT output or BNC connector.
- What is the pulse width that is needed?
- What should the rise time of the double-exponential transient be?
- What is my pulse impedance (Ri)?
- Assuming a matched load (RL = Ri) how should the pulse react to the load? This is the greatest influence of the overall energy content of the pulse.

You could start now using either of the supplied tools, but it is often useful to understand some background information.

4.1 What happens during pulse firing?

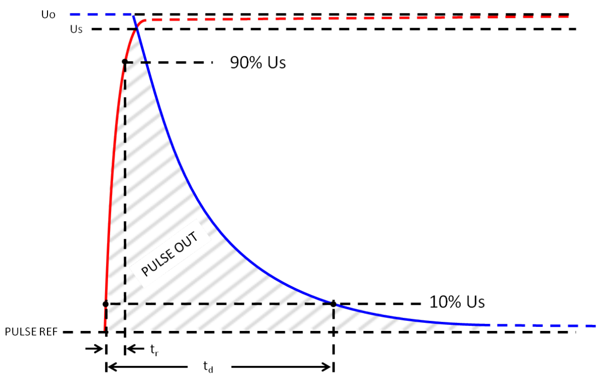


Firing a pulse

- Before firing a pulse, the buffer/storage capacitor has to be charged with the voltage from the HVPSU (o).
- A fire signal, handled within the FLX 5510 module, sets SW1 to the discharge position to discharge C_W through the pulse-shaping network consisting of R_W, R_R, C_R and R_i.
- The pulse width is determined by C_W and R_W with the formula $\tau = R_W * C_W$ where τ is the capacitive time constant.
- The rule of thumb is that td (measured from 10% to 10% of the peak voltage US) is 2.3 times τ. This is discussed in more detail later.
- R_R and C_R choose the rise time. More details later.
- R_i is the pulse impedance of the pulse, thus limiting the overall energy of the discharge circuit. However, it Ri combines with RR and the equivalent series resistance (ESR) of C_W to determine the real R_i.
- The pulse is then coupled through the FLX 5510 module to the CDN, and therefore the EUT output or BNC output connector.

Uo is selected in AutoStar, but Uo – and the limits therefore must be known because it has an influence on some of the maximum limitations of the DIY 5510, FLX 5510 and the overall system.

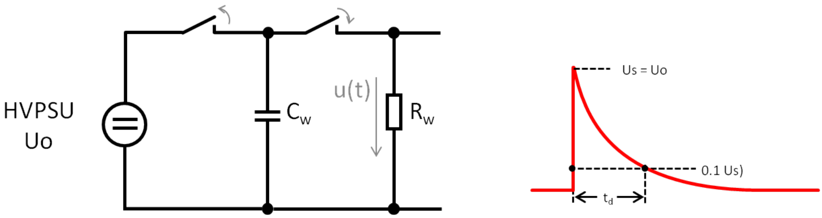
While you set Uo in AutoStar, Uo is usually not exactly what you'll get at the output (Us) because there are some losses inherent in a capacitive discharge network, and how they work. While all of the Teseq modules (e.g. MT 5511) are adjusted and calibrated to take these losses into account, the FLX 5510 and its project-oriented approach, cannot. Therefore, it is important to design some headroom in the maximum voltage of the capacitor when you are considering the peak voltage Us that you want to get at the output.



Uo is not exactly Us

5 DETERMINING THE COMPONENTS USED

To begin determining the components needed you'll need to know the overall pulse width of the test circuit. Consider the following simplified circuit.



Simplified circuit for determining t_d

As introduced earlier, pulse width is determined by these general rules:

- $\tau = R_W * C_W$
- td is 2.3 times τ.

This of course, is a slight simplification as it ignores the influence of difference between Us and Uo.

Perhaps it is best to explain these general rules with a explanation of how we've arrived at these values.

$$u(t) = Uo \cdot e^{-\frac{t}{CwRw}}$$

$$\Rightarrow 0.1 = e^{-\frac{td}{CwRw}}$$

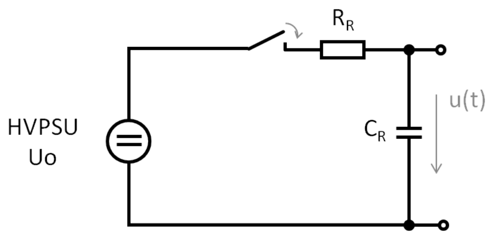
$$\Rightarrow td \approx 2.3 \cdot CwRw$$

Calculating t_d

Another factor that can effect U_S and t_d is the rise time.

Rise time is shaped with the components used for R_R and C_R. Some transient generators use an inducter for this value, but we've found that we get much cleaner pulses using a secondary R/C network for this. Of course, this is your project, so you're free to shape the rise time as you like, but the DIY 5510 submodule is conveniently marked where to place R_R and C_R. and the rest of this guide assumes that you will use this recommended method.

When thinking about selecting the rise time, consider the following simplified circuit which does not show the pulse width components.



Simplified schematic for t_r

ISO 7637-2 calls these types of transients “double-exponential” which indicates that the rise time is also an exponential shape – and it is. Using R_R and C_R to delay the rate of increase of U_S seen at the output. This exponential shape can be seen in the formula used to arrive at the rise time calculations.

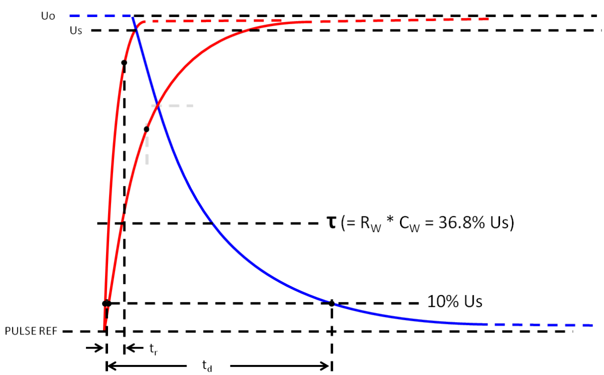
$$u(t) = Uo\left(1 - e^{-\frac{t}{RrCr}}\right)$$

$$\Rightarrow tr \approx 2.2 \cdot RC$$

Calculating t_r

A moment ago, I described that rise time (t_r) has an influence on the pulse voltage seen at the output (U_S) and it becomes clear when one considers the “other” exponential part of the “double-exponential” pulse shape.

As you can see below, the slower the rise time, the greater the influence on the U_S as well at t_d.



Influences of long t_r

You are free to design the circuit any way you like, but we recommend keeping the ratio of t_d to t_r at least 5:1 to keep these difficult-to-calculate influences to a minimum. Keep in mind, ISO 7637-2 uses a ratio of 30:1 and more!

In fact, to keep this guide as user-friendly as possible, we ignore these influences altogether for the purposes of the calculations used with the FLX 5510.

The final variable that we have not yet discussed is Ri. Ri is the peak current limiting component of transients commonly used in EMC applications. While Ri has very little influence to an unloaded pulse, it determines to a great extent (second only to C_W and R_W) how the pulse behaves when loaded!

This, of course, highlights one main advantage of the FLX 5510 system: you determine the overall pulse characteristic of your pulse, including peak current!

Ri can be any value you like, but we recommend >0.4 Ω. Generally this is the lowest value you would find in any EMC standard. The most important limitation of the FLX 5510 is peak current of SW1 must be less than 300 A pk. SW1, a pair of electronic switches, is built into the FLX 5510 and is not user replaceable, so you should pay close attention to this factor.

!

CAUTION! The peak current of SW1 should never exceed 300 A! SW1 is built in to the FLX 5510 and is not user-replaceable.

As you'll see in the next chapter, we offer some usable tools to help you achieve the pulse that your application demands.

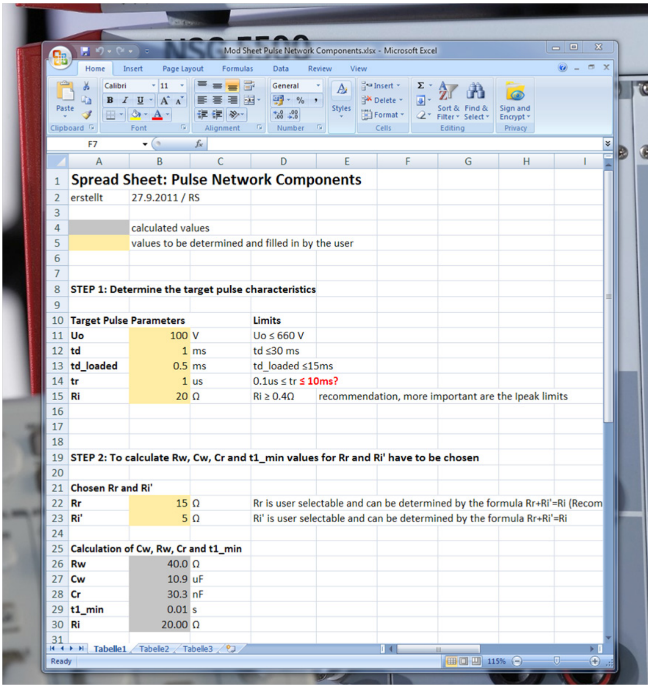
6 THE INCLUDED TOOLS

Included in the delivery are two tools to help you get started:

- An Excel Sheet “Mod Sheet Pulse Network Components”
- A Windows Application “FLX5510_Tool.exe”

6.1 Excel tool

The provided excel sheet can be used for users who are interested in defining and saving their own customized pulses, as well as gaining a deeper understanding of the calculations that are used.



The provided Excel sheet

6.1.1 Using the Excel tool

To use the excel tool, the first parameters to be considered in STEP 1 is what output parameters does the pulse have. You'll need to define:

- The charging voltage of the storage capacitor Uo. Remember, Uo is not the same as the peak voltage seen at the output as described in previous chapter.
- The pulse width (t_d) and the pulse width under load where $R_i = R_L$ (load in Ohms)
- The rise time (t_r)
- The pulse impedance (Ri)

Pay attention to the limits (and recommended limits in red) and enter the values in the spaces provided and move on to the next step.

Because R_r and Ri' have an influence on calculating the overall components needed for the following steps so you'll want to enter them in STEP 2. Both of these values are user selectable, but the real Ri as seen at the output connector can be determined by the formula R_r + Ri' = Ri. We recommend that R_r < Ri'/3 if you're hoping to minimize the influence on t_r under load.

Now that you have both your desired pulse parameters and Rr and Ri' defined, the components to be used are automatically calculated.

Often, you'll need to tune final values, and STEP 4 provides a way to do this. You may need to tune these components if:

- The calculated value isn't one that is commonly available, even if putting the components in series or parallel
- The influences of t_r on the overall pulse shape is higher than expected
- Small losses in the layout and coupler are outside the tolerances you had expected

This last step helps you also determine how much power you'll need for the components.

Pay special attention to the limits and advice given, or damage can occur to the DIY 5510 submodule, FLX 5510 module or the NSG 5500 system.

! **CAUTION! The peak current of SW1 should never exceed 300 A!**

! **CAUTION! The limits given in the tools and in this guide must be carefully observed or damage can occur to the DIY 5510 submodule, FLX 5510 module or the NSG 5500 system!**

For example, when determining the overall power of each component, T1 (pulse repetition time) is relevant as it helps to calculate the average power. In other words, that sufficient time between pulses exists to allow the components to cool before firing the next pulse.

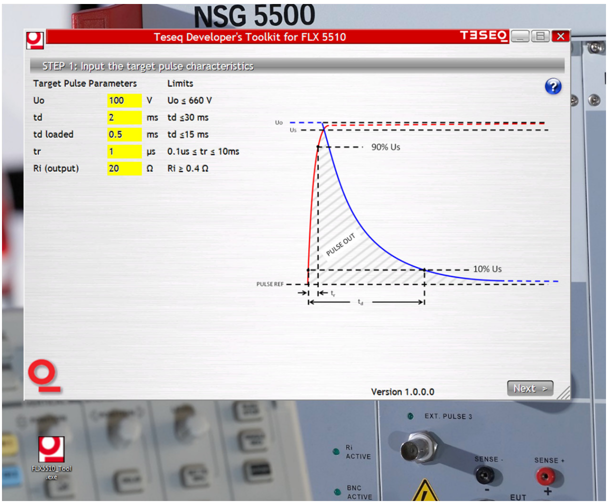
Finally, the estimated actual pulse output is calculated.

6.2 FLX 5510 Wizard (Windows application tool)

You are also provided with a tool to simplify the design of the DIY 5510 module that contains the pulse network. This tool gives the user a way of calculating the pulse network needed to achieve the wanted pulse at the output. Additionally, every reasonable effort has been used to make sure that you do not exceed any of the parameters, and the software will give you useful hints and visual clues to help you design the circuit and notify you of any errors or of any parameters that have been exceeded.

6.2.1 The using FLX 5510 Wizard

On opening the FLX 5510 application you are presented with the pulse characteristics.



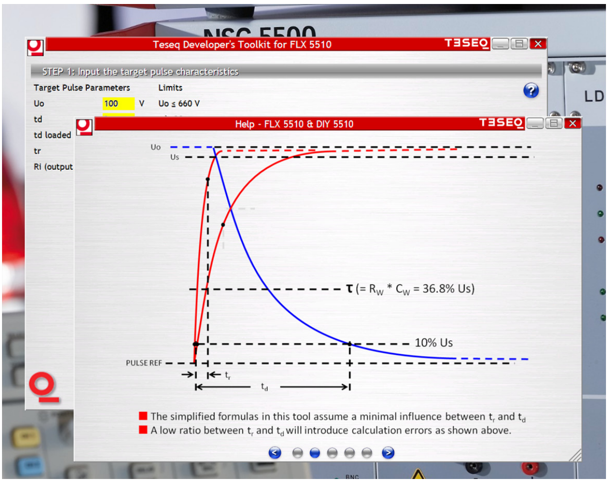
Starting the FLX 5510 tool

To use the application, the first parameters to be considered in STEP 1 is what output parameters does the pulse have. You'll need to define:

- The charging voltage of the storage capacitor Uo.
  Remember, Uo is not the same as the peak voltage seen at the output as described in the previous chapter.
- The pulse width (t_d) and the pulse width under load where $R_i = R_L$ (load in Ohms)
- The rise time (t_r)
- The pulse impedance (Ri)

Note the limits and enter the values in the spaces provided and move on to the next step. Any values outside the limits will not be accepted and you'll have to enter them again.

Press the help icon at any time for additional assistance. This is generally a very brief overview of the details provided in this guide to help you understand the parameters and limits being defined in the tool.



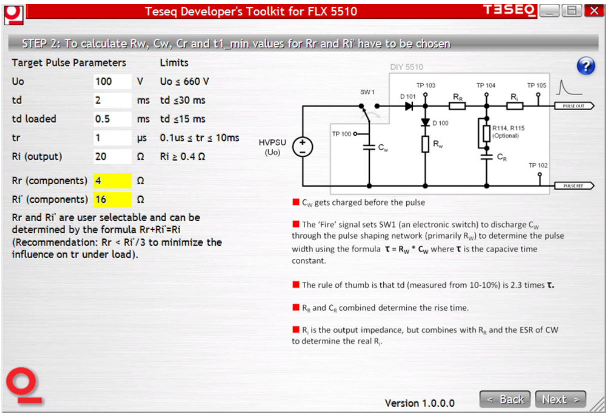
Help guides to the FLX 5510 tool

Once you’ve input the desired values in STEP 1, press Next to continue to STEP 2.

In STEP 2, you’re presented with a choice of R_r and Ri’ because they have an influence on calculating the overall components needed for the following steps so you’ll want to enter them in STEP 2. By default, R_r and Ri’ are automatically

Once you’ve input the desired values in STEP 1, press Next to continue to STEP 2.

In STEP 2, you’re presented with a choice of R_r and Ri’ because they have an influence on calculating the overall components needed for the following steps so you’ll want to enter them in STEP 2. By default, R_r and Ri’ are automatically calculated with a ratio of 4:1 of the Ri value given during STEP 1. However, both of these values are user selectable, but the real Ri as seen at the output connector can be determined by the formula R_r + Ri’ = Ri. We recommend that R_r < Ri’/3 if you’re hoping to minimize the influence on t_r under load.



Choose Ri’ and R_r

Now that you have both your desired pulse parameters and Rr and Ri' defined, click Next to have the components to be used automatically calculated.

Often, you'll need to tune final values, and STEP 3 provides a way to do this. You may need to tune these components if:

- The calculated value isn't one that is commonly available, even if putting the components in series or parallel
- The influences of t_r on the overall pulse shape is higher than expected
- Small losses in the layout and coupler are outside the tolerances you had expected

This last step helps you also determine what components to use and how much power you'll need for each of them.

Pay special attention to the limits and advice given, or damage can occur to the DIY 5510 submodule, FLX 5510 module or the NSG 5500 system.

! **CAUTION! The peak current of SW1 should never exceed 300 A!**

! **CAUTION! The limits given in the tools and in this guide must be carefully observed or damage can occur to the DIY 5510 submodule, FLX 5510 module or the NSG 5500 system!**

For example, when determining the overall power of each component, T1 (pulse repetition time) is relevant as it helps to calculate the average power. In other words, that sufficient time between pulses exists to allow the components to cool before firing the next pulse.

Fine tuning and checking

The application gives you the ability to indicate if you are going to be using the BNC output. Because the BNC output has a lower voltage and current limit than the EUT output through the CDN, this affects the limits that can be selected.

Finally, the estimated actual pulse output is calculated.
If any limits are detected, you will be notified by fields with a red background.

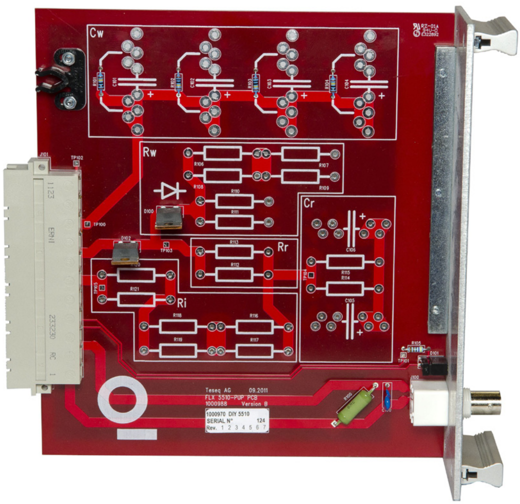
Warnings need corrected.

You should correct any warnings before proceeding to populating the components as described in the next chapter.

7 POPULATING THE DIY 5510

Once you have finished performing the calculations using one of the provided tools, you are ready to assemble the DIY 5510 into your finished project.

> **!** **CAUTION! You will be soldering discreet components onto the DIY 5510 which entails high heat, fumes and hand tools. This should only be performed by trained individuals using the proper ventilation, eye protection training and supervision.**



The DIY 5510 unpopulated

7.1 The storage capacitor(s) C_W

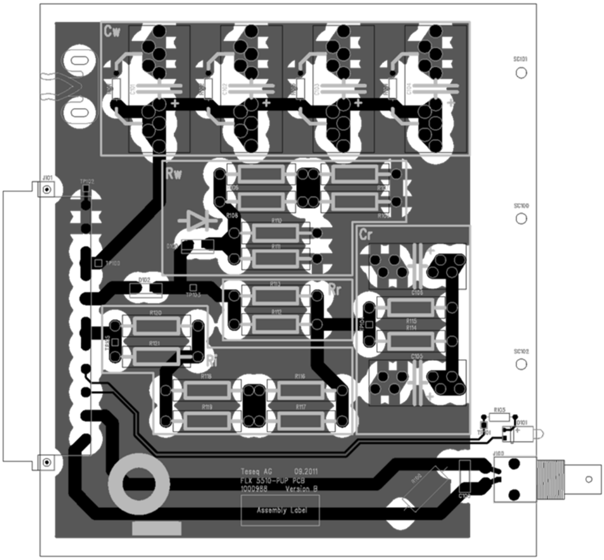
A block has been provided for the storage capacitor(s) C_W with the labels C101 – C104. C101 – C104 are all in parallel allowing you to have quite a large energy storage for your pulses. Of course, capacitors in parallel add so adding additional parallel capacitors of the same type and value will double the energy storage.

If polarized capacitors are used, please note the polarity indicators written on the DIY 5510. In all cases, pulse polarity at the output is determined by a polarity relay in the FLX 5510.

Additionally, discharge resistors R101 – R104, each with a value of 1 MΩ are there to ensure that C_W is safely discharged after removal from the module and therefore the HVPSU.

7.2 The discharge resistor(s) R_W

Alongside CW, forming the backbone of the pulse network R/C is R_W. R_W is made up of a series/parallel network consisting of R106-R111. As this is a series parallel network, you should consult the layout guide shown below and provide shorting wire if necessary to bypass unused slots that may be in series with the pulse network. Assuming the same resistor values, resistors in parallel halve the resistance, but double the current-carrying capability, it may be useful to use any of the series and/or parallel paths to achieve both the resistance and the power needed.



The layout of the DIY 5510

7.3 The rise time network R_r and C_r

R_r and C_r are used to shape the rise time of the pulse.

The positions for R113 and R114 are provided for R_r. Note that while these are both in parallel, they are in series with the pulse output and therefore, muse be populated or you will have no pulse at the output connector.

Also, R_r is summed with Ri to determine the real Ri of the pulse network.

C_r helps to determine the rise time and positions C106 and C107 are provided for this. The optional R114 and R115 are provided for rise time fine tuning, but they are in series with C106 and C107 and therefore should be bypassed with bus-wire if they are not used. You will see this in the provided example DIY 5510. If polarized capacitors are used, please note the polarity indicators written on the DIY 5510. Actual pulse polarity at the output is determined by a polarity relay in the FLX 5510.

7.4 The pulse impedance Ri

The series/parallel network consisting of R116 – R121 is prepared for population of the Ri value needed. Remember that R_r contributes to the overall Ri value. Also, if not all the positions are populated, consult the layout guide, and the example DIY 5510 to determine what, if any, positions should be connected with bus wire.

7.5 Diodes D100 and D102

The diodes D100 and D102 are an integral part of the charge and coupling subsystems and should not be removed or bypassed.

8 LIMITS OF THE FLX 5510 AND DIY 5510

Of course, all of the components in a system are limited by some factor: the size and specification of the switch, connector or trace on a PCB all contributes to this. While we've provided as much help using the design tools included, an overview of all limits of the system are provided here for reference.

ABSOLUT MAXIMUM RATINGS FLX 5510	**Min.**	**Max.**
I_switch_max (td_loaded < 5 ms / tr < 0.1 ms)		300 A
I_switch_max (2 ms < td_loaded ≤ 15 ms / tr ≤ 10 ms)		150 A
Imax (EUT) (td_loaded < 5 ms / tr < 0.1 ms)		150 A
Imax (EUT) (2 ms < td_loaded ≤ 15 ms / tr ≤ 10 ms)		75 A
Imax (BNC) (td_loaded < 5 ms / tr < 0.1 ms)		100 A
Imax (BNC) (2 ms < td_loaded ≤ 15 ms / tr ≤ 10 ms)		50 A

9 USAGE OF THE FLX 5510 AND DIY 5510

9.1 Using the FLX 5510 and DIY 5510

Once you've calculated the pulse network using one of the provided tools, and observing the limits indicated in the previous chapter, populated the DIY 5510 module, you are ready to put it in operation. To use the DIY module, slide it into the provided slot in the FLX 5510 module. The DIY 5510 module should be held by the clip that mates to the the corresponding nib in the FLX 5510 module.

Note: It is recommended to use the provided writeable surface on the DIY 5510 submodule. AutoStar does not know, nor is there is any limit in AutoStar 5.x for the DIY 5510, so it can be possible to overstress the components on the DIY 5510 submodule if false parameters in the software are used.

To use the FLX 5510 module, power the NSG 5500 off and slide the module into a free space in the NSG 5500 system and affix the four screws or use the slot occupied by the MT 5510.

Once the FLX 5510 module is inserted and contains one DIY 5510 submodule, you can now start the NSG 5500. After allowing approximately 10 seconds for the NSG 5500 to boot, you can then start AutoStar 5.x.

! **WARNING! The NSG 5500 shall be completly turned off before replacing, adding or removing a DIY 5510 module. Hazardous voltages exist on the DIY 5510 and inside the FLX 5510.**

! **WARNING! Damage can occur to the system if a FLX 5510 module is inserted or removed from the NSG 5500 when powered on! Be sure to affix the four provided screws on the FLX 5500 before putting the module into operation to avoid accidentally removing the FLX 5510 during use.**

!

CAUTION! The FLX 5510 features a steel enclosure to protect the module in the event of operator error or abuse. This enclosure, however, is not guaranteed fireproof. Use the FLX 5510 module only under close observation until it is certain that no components are reversed, overstressed or underdimensioned. In case of operator or calculation error, the DIY 5510 and the populated components may be damaged. It is not recommended to reuse a DIY 5510 submodule that has been damaged. Please order replacement submodules from Teseq.

!

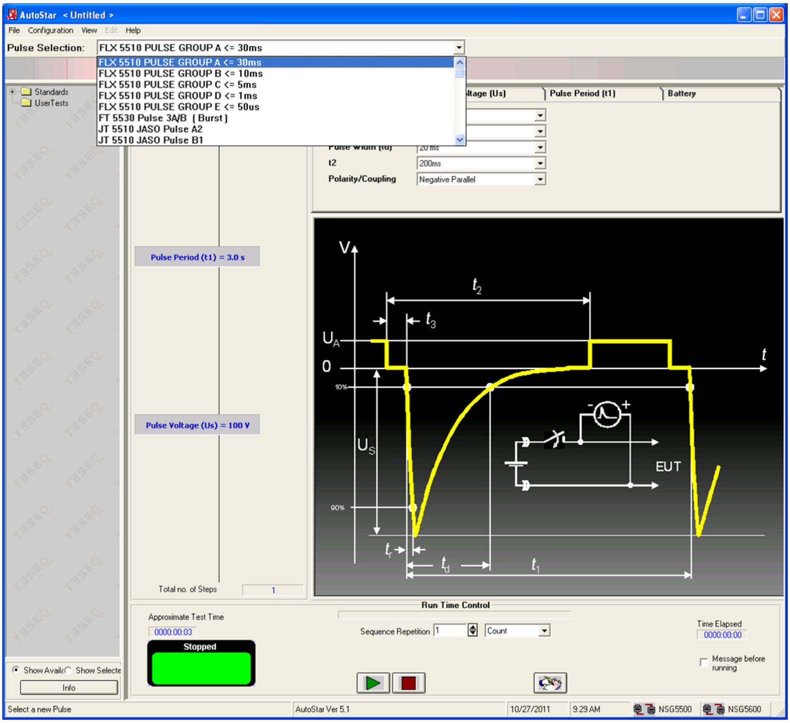
CAUTION! This guide is meant to be used only in conjunction with the NSG 5500 user manual. Be sure to read and understand all relevant safety instructions in the NSG 5500 user manual.

9.2 Using the FLX 5510 module with AutoStar 5.x

Once the FLX 5510 is fitted with a DIY 5510 and the NSG 5500 is booted, you are ready to start AutoStar.

Note: The provided patch for AutoStar 5.x is necessary for the module to be detected by the system. If no FLX 5510 module is detected by the system, be sure that the patch has been installed to the AutoStar directory.

On starting AutoStar, you will see the FLX 5510 module listed under pulse selection.



Selecting a FLX 5510 pulse

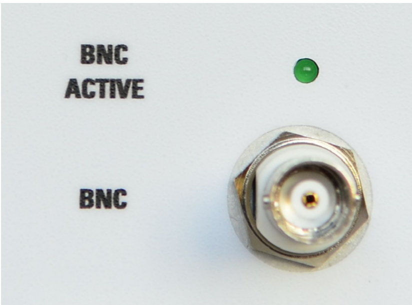
The DIY 5510 module is a so-called "dumb" module: it provides no feedback to the rest of the system about what its limits or capabilities are. You are, therefore provided with a short list of possible pulses and a range of parameters to select.

You'll want to select the pulse parameters closest to those that you've calculated using one of the available tools.

When running a pulse, pay special attention to parameters that are limited by your DIY 5510 design such as US (peak voltage) and T1 (repetition rate) as inputting incorrect values can damage components on the DIY 5510 module or in extreme cases the FLX 5510 module.

CAUTION! It is recommended to use the provided writeable surface on the DIY 5510 submodule. AutoStar does not know, nor is there is any limit in AutoStar 5.x for the DIY 5510, so it could be possible to overstress the components on the DIY 5510 submodule if false parameters in the software are used.

Using AutoStar, it is possible to output the pulse in either polarity to the main EUT output on the NSG 5500 or the BNC connector on the front of the DIY 5510 submodule. An indicator will light when the BNC connecter is used.



Using the BNC connector

Note: For other indicators on the FLX 5510, consult the NSG 5500 User manual

Likewise, the FLX 5510 provides all of the powerful features found in AutoStar for other transient modules, such as:

- The ability to set the US voltage (as a function of Uo found in previous chapters)
- The ability to set the polarity and coupling modes
- The ability to set the necessary timings for battery off time and repetition rate (within the limits of your design)
- The ability to document a test run
- The ability to start, stop and sequence a test run
- The ability to use our high-quality 100 A built-in CDN or selectively, the BNC output (US ≤500 V at the BNC connector)
- The ability to save User Tests or tests to .PLS files

10 MAINTENANCE

Under normal conditions, it does not take much effort to keep your test equipment in good working order.

! **CAUTION! Protect the equipment against moisture, heat and dust.**

10.1 Cleaning the equipment

To clean the equipment, use a dry, clean cloth. Never use water, any other liquid or detergent.

Headquarters

Teseq AG
4542 Luterbach, Switzerland
T +41 32 681 40 40
F +41 32 681 40 48
sales@teseq.com
www.teseq.com

Manufacturer

Teseq AG
4542 Luterbach, Switzerland
T +41 32 681 40 40
F +41 32 681 40 48
sales@teseq.com

China

Teseq Company Limited
T +86 10 8460 8080
F +86 10 8460 8078
chinasales@teseq.com

France

Teseq Sarl
T +33 1 39 47 42 21
F +33 1 39 47 40 92
francesales@teseq.com

Germany

Teseq GmbH
T +49 30 5659 8835
F +49 30 5659 8834
desales@teseq.com

Japan

Teseq K.K.
T +81 3 5725 9460
F +81 3 5725 9461
japansales@teseq.com

Singapore

Teseq Pte Ltd.
T +65 6846 2488
F +65 6841 4282
singaporesales@teseq.com

Switzerland

Teseq AG
T +41 32 681 40 50
F +41 32 681 40 48
sales@teseq.com

Taiwan

Teseq Ltd.
T +886 2 2917 8080
F +886 2 2917 2626
taiwansales@teseq.com

UK

Teseq Ltd.
T +44 845 074 0660
F +44 845 074 0656
uksales@teseq.com

USA

Teseq Inc.
T +1 732 417 0501
F +1 732 417 0511
Toll free +1 888 417 0501
usasales@teseq.com

To find your local partner within Teseq®'s global network, please go to **www.teseq.com**

Specifications subject to change without notice. Teseq® is an ISO-registered company. Its products are designed and manufactured under the strict quality and environmental requirements of the ISO 9001. This document has been carefully checked. However, Teseq® does not assume any liability for errors or inaccuracies.